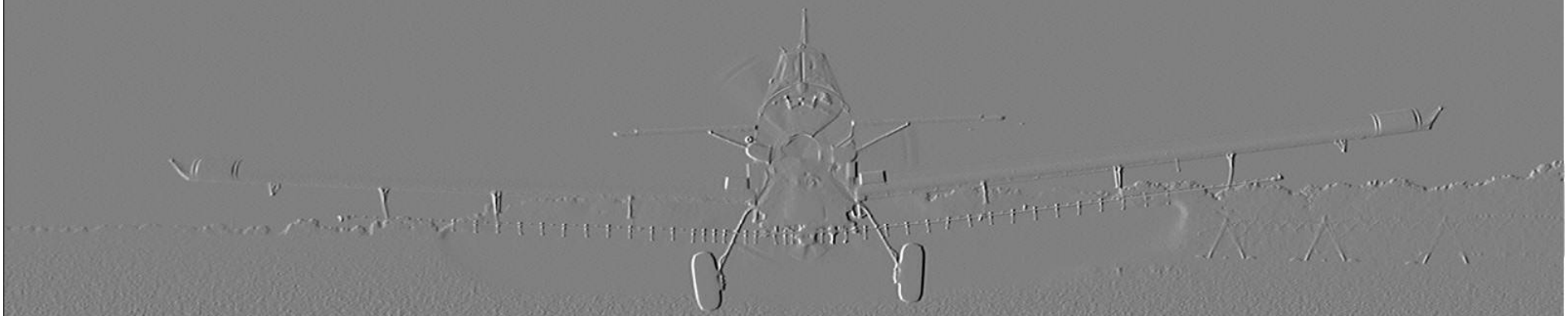
Recent Advances in Aerial Application: Impact on VOC Reduction



Clint Hoffmann
Agricultural Engineer & Lead Scientist
USDA-ARS
Areawide Pest Management Research Unit
Aerial Application Technology Group
College Station, TX

United States Department Of Agriculture
Agricultural Research Service

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VOC Reductions from Pesticides
Sacramento, CA 22 May 07

Aerial Application and VOC's Reduction

- VOC's are released during and after application with drift being a major concern during application;
- Spray drift can and is being mitigated through proper equipment selection and operation;
- Our research focuses on the application of crop production and protection materials.

Overview

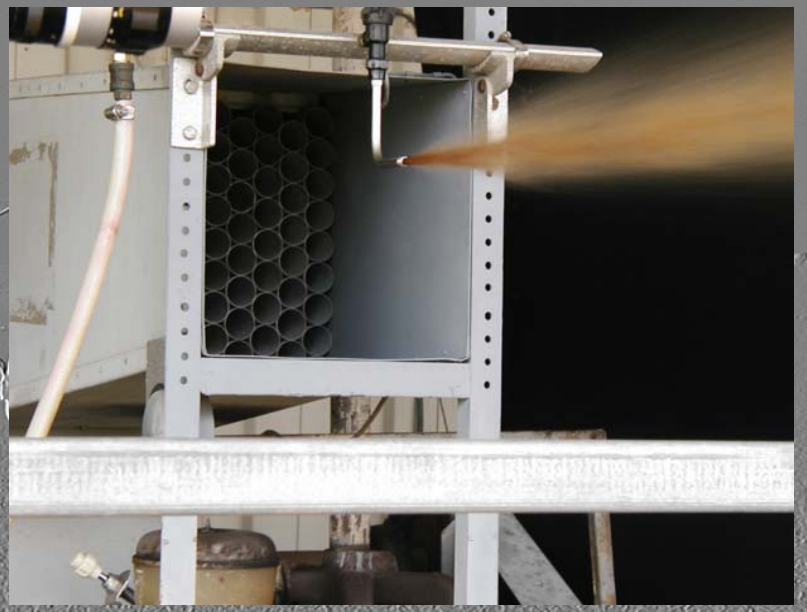
- A brief overview of the USDA-ARS-Aerial Application Group in College Station;
- Recent developments in aerial application and how they may help in VOC reduction;
- Future developments in the industry.

Research Objectives for Aerial Application Group

- Develop and integrate GIS, GPS, and other systems for efficacious precision application;
- Develop technologies that account for material released during crop spray applications;
- Develop and evaluate application technologies with emphasis on reducing driftable fines and improving efficacy;
- Determine effects of meteorological conditions on off-target movements of sprays;
- Develop and evaluate systems for aerial delivery of new crop pest management materials.

Facilities at College Station

- 3 wind tunnels: 1 ft X 1 ft, 3 ft X 3ft, and 6 ft X 6 ft with airspeed ranges of 1-160 mph;
- Droplet measurements: IMAQ/CCD camera for cards, PMS and LaVision for atomization studies and droplet velocity and trajectory
- Deposition measurements: GC, fluorometers, colorimeters, etc.



Aircraft Fleet

Cessna 206 – 4 passenger plane

AirTractor 402B Turbine – 400 gal hopper

AgHusky – 100 & 120 gal hoppers

Hiller 12E Helicopter – 60 gal hopper

2007 Research Plans

- Development of electronic sensor to measure aerial spray droplets;
- Spray deposition uniformity across multiple swaths with real-time swath adjustments;
- Droplet size analysis of thermal foggers;
- Effect of adjuvants physical properties on spray characteristics;
- Remote sensing for insect damage mapping;
- Collection efficiencies of airborne spray samplers;
- Atmospheric stability measurements with the AIMMS;

2007 Research Plans

- Atmospheric and stability effects on fate and transport of aerially applied sprays;
- Evaluation of drift from electrostatic and conventional sprayers;
- Evaluation of efficacy of application for weed control with glyphosate from conventional, rotary and electrostatics nozzles;
- Evaluation of application technologies for deposition and efficacy;
- Mass accountability of aerial applied sprays.

Our Goal

- Our goal is to continue to support the scientific and aerial application communities with timely and beneficial research.
  - We are always open to suggestions and comments on needs or issues facing the industry.

Advances in Aerial Application: Implication for VOC Reduction

- Precision Application;
- On Board Meteorological Systems;
- Optimization of Applications by Operating Dispersion Model in Real time;
- EPA Drift Reduction Technology (DRT) program.

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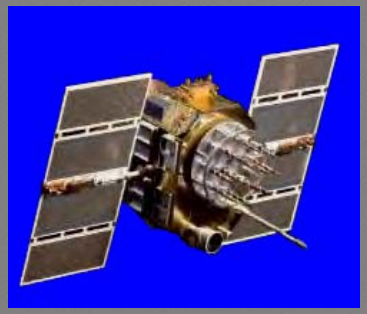
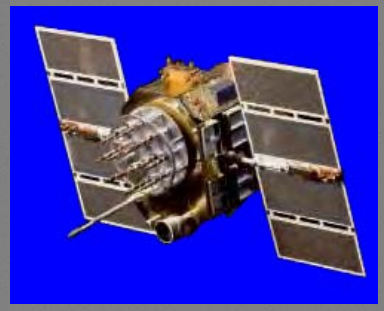
Precision Application

- Applications are targeted to specific areas of the field;
- Incorporation of remote sensing data, GIS data, precision sprayers (variable rate), and yield monitors;
- All inputs can be weighed against their benefit to yield on a very small scale (10-50 ft^2 areas).
- During a recent conversation with a farmer, he stated that “he wanted to farm by the square foot not on a field by field basis.”



Tomorrow's Reality

GPS/GIS



Site-Specific Tools

Courtesy of Dale Magoun, LSU

Impacts of Precision Application on VOC Reductions

- Reduces or eliminates treating areas of the field that would not benefit from or need a treatment;
- Reduction of active ingredients without affecting efficacy;
- Remember: Efficacy is the bottom line and reason for making application.

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AIMMS-20 System by Aventech Research

Networked system of 4 ‘smart’ autonomous modules

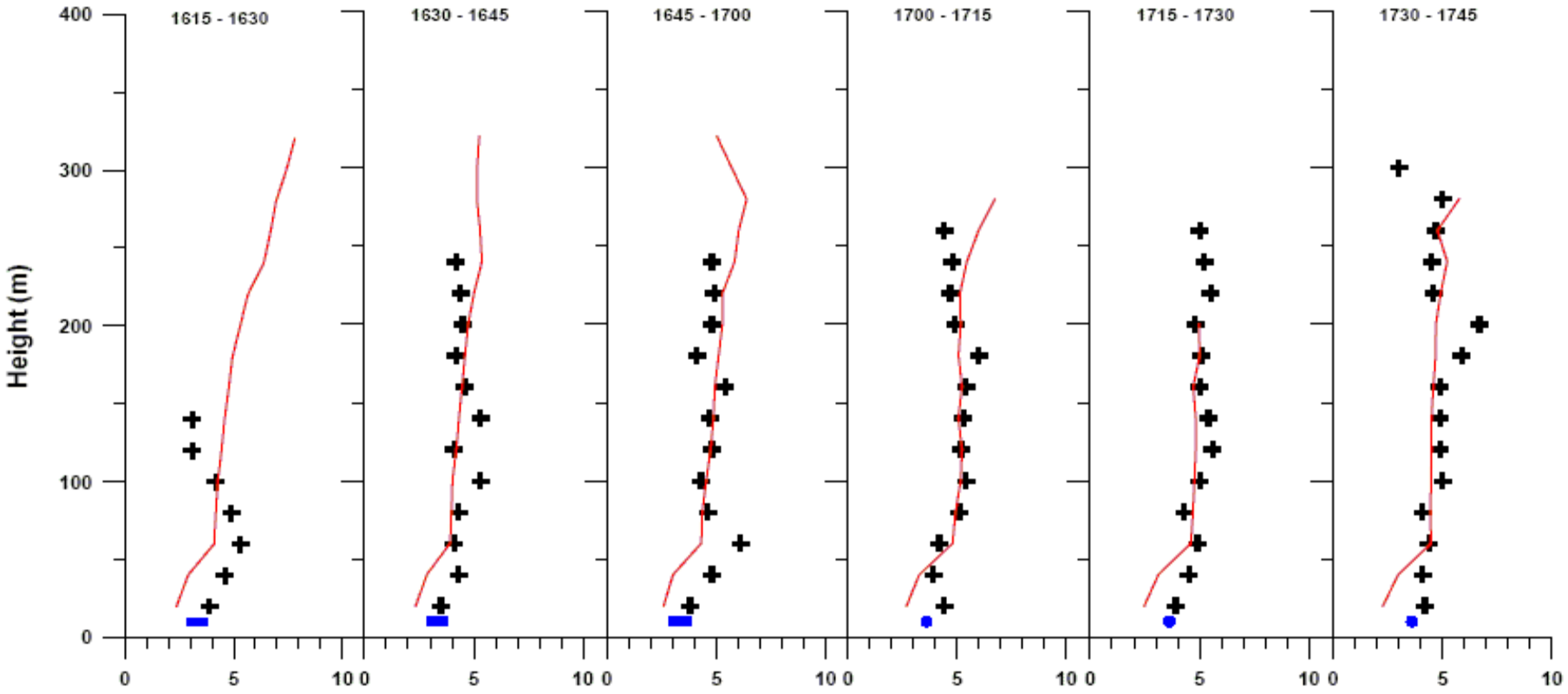
Air Data Probe

- True Air Speed and direction over field
- Temperature
- Humidity

Applications of AIMMS System

- Record of meteorology during application (drift incidents implications);
- Real-time data for decision making (wind direction and atmospheric stability (researching))
- Real-time data and interaction with GPS navigation systems for optimized spray applications
  - Mosquito vector control applications
  - Forestry optimized applications
  - Agricultural precision applicaitons

AIMMS-20 Inter-Comparison



Comparison of AIMMS-20 and SODAR wind profiles for the 1615 – 1745 period. (✚ AIMMS-20, _____ SODAR, -- Environment Canada tower)

From: Mickle, R.E., "Evaluation of the AIMMS-20 Airborne Meteorological Package," SERG, 2004

Implication of Met System on VOC Reduction

- Warning to applicator to avoid a certain or predefined limit on meteorological conditions (i.e. wind >15 mph, stable atmosphere, T and RH);
- Reduction in chance of off-target spray movement;
- May lead to development of VOC Emission models that incorporate real-time data.

Optimized Applications

- Integration of AIMMS, GPS precision application system, and AGDISP
  - Wind speed and direction values are acquired and transmitted to the existing on-board GPS navigation computer where a spray-drift model initiates real-time navigation corrections dependent on the prevailing wind conditions at application height.
  - Calculation of “real-time” volatilization or evaporative index during application.

ADAPCO Wingman™ GX

- Receiving real-time multilevel meteorology from the AIMMS 20TM, KitoonTM or Tower Meteorology StationTM, the Wingman™ GX instantaneously resolves the proper offset and altitude of the aircraft resulting in the greatest deposition onto the intended target while minimizing off target drift. In real-time, the pilot sees where the spray-cloud is drifting.
  - This is achieved by combining the real-time meteorology with the USDA Forestry Service AGDISP model within the Wingman™ GX.
    - The Wingman™ GX and PC based SkyTracker™ software are built upon ESRI standard SHAPE files.

EPA's Drift Reduction Technology (DRT) Program

- EPA-led initiative program to:

  "achieve improved environmental and human health protection through drift reduction by accelerating the acceptance and use of improved and cost-effective application technologies."

- This is a partnership with other governmental agencies, industry, academia and other stakeholders.

EPA's DRT Program

- Benefit
  - Proven technologies will be considered in EPA's scientific review of pesticides and development of spray drift reduction for product labels.
    - i.e. Acknowledged by EPA as potential drift reducer under specified scenarios as well as potential labeling benefits.

EPA's DRT Program

- EPA risk assessment are correlated to deposition downwind from an application.
  - Therefore, results from this verification will be used to estimated downwind deposition.
- DRT is compared to a "Reference System" to determine drift reduction potential.

Categories of DRTs

- Spray nozzles
  - e.g. atomizers with fewer fines
- Sprayer modifications (passive)
  - e.g. shields and shrouds, wingtip devices
- Spray delivery assistance (active)
  - e.g. air assisted spraying
- Spray property modifiers
  - e.g. formulation/tank mix ingredients that modify spray solution physical properties
- Landscape modifications
  - e.g. artificial or natural hedges and shelterbelts

DRT Effects on VOC Reduction

- Reduction of drift through EPA approved equipment;
- Better understanding of drift and subsequent VOC emissions;
- System to evaluate new formulations;
- Method to encourage and “reward” adoption of new technologies.

Future Issues

- Further integration of previously mentioned technologies;
- Impact of EPA DRT program on applicator and product labels;
- Better understanding of VOC generation may lead to timing of sprays based on meteorological conditions (current and future).

Contact Information for Aerial Application Technology Team

- Clint Hoffmann
- Office: 979-260-9521, Cell: 979-777-0815
- Email: choffmann@tamu.edu

- Brad Fritz: 979-260-9227
- Juan Lopez: 979-260-9530
- Dan Martin: 979-260-9290
- Yubin Lan: 979-260-3759

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Thank You

USDA ARS
Aerial Application Technology Team
Website: **apmru.usda.gov**

-- WORKING FOR APPLICATORS --